The claims are pending as follows:

1.   (Previously Presented) A disk array apparatus connected to an information processing apparatus so as to be able to communicate therewith, comprising:

a plurality of hard disk drives; and

a controller constructed by including a host interface which receives a request for a data read and request for a data write from/to said hard disk drives from said information processing apparatus, a disk interface connected to said hard disk drives so as to be able to communicate therewith through a communication path which performs data input/output to/from said hard disk drives, a memory, a CPU which controls said host interface, said disk interface, and a time counting mechanism,

wherein a logical volume is formed in a RAID group with disk drive redundancy made up of a plurality of said hard disk drives, said disk array apparatus comprising:

an access time storage section which stores, upon reception of a request for a data read or request for a data write from/to said logical volume from said information processing apparatus, a time acquired from said time counting mechanism as an access time in said memory in association with an identifier of said RAID group in which said logical volume is formed; and

a power saving mode execution section which refers to said access time stored in said memory and sets a number of said hard disk drives according to the redundancy of said RAID group to a power saving mode when the difference between a current time acquired from said time counting mechanism and said access time exceeds a certain time.

2.   (Original) The disk array apparatus according to claim 1, further comprising a plurality of communication paths which connect said disk interface and said plurality of hard disk drives,

wherein said hard disk drives are connected to any one of said communication paths so as to be able to communicate therewith,

a communication path selection section which selects said communication

path having the least number of said hard disk drives in a power saving mode is provided, and

said power saving mode execution section sets said hard disk drives connected so as to be able to communicate with said communication path selected by said communication path selection section to a power saving mode.

3.   (Original) The disk array apparatus according to claim 1, further comprising:

a read request responding section which responds, upon reception of said request for a read from said logical volume formed by including said hard disk drives in said power saving mode from said information processing apparatus, to said read request using the redundancy of said RAID group from said hard disk drives not in a power saving mode out of said hard disk drives making up said logical volume; and

a power saving mode cancellation section which cancels the power saving mode of said hard disk drives in a power saving mode after said read request responding section responds to said read request.

4.   (Original) The disk array apparatus according to claim 1, further comprising:

a spare drive storage section which stores duplicates of data stored in said hard disk drives in spare drives which are reserved drives for said hard disk drives before said power saving mode execution section sets said hard disk drives to a power saving mode;

a write request responding section which responds, upon reception of said request for a write to said logical volume formed by including said hard disk drives in a power saving mode, to said write request by regarding said hard disk drives not in a power saving mode out of said hard disk drives making up said logical volume and said spare drives as said RAID group in which said logical volume is formed; and

a power saving mode cancellation section which cancels the power saving mode of said hard disk drives in a power saving mode after said write request responding section responds to said write request and stores duplicates of data stored in said spare drives in said hard disk drives whose power saving mode has been canceled.

5.   (Original) The disk array apparatus according to claim 4, further comprising a position information storage section which stores position information of the data written in said spare drives by said write request responding section according to said write request in said memory,

wherein said power saving mode cancellation section stores duplicates of said data stored in the positions indicated by said position information of said spare drives in said hard disk drives whose power saving mode has been canceled.

6.   (Original) The disk array apparatus according to claim 1, further comprising:

a write request responding section which writes, upon reception of said request for a write to said logical volume formed by including said hard disk drives in a power saving mode, the data accompanying said write request in only said hard disk drives not in a power saving mode out of said hard disk drives making up said logical volume and responds to said write request; and

a power saving mode cancellation section which cancels the power saving mode of said hard disk drives in a power saving mode after said write request responding section responds to said write request, generates data to be stored in said hard disk drives in a power saving mode using the redundancy of said RAID group from the data stored in said hard disk drives not in a power saving mode out of said hard disk drives making up said logical volume and stores said data generated in said hard disk drives whose power saving mode has been canceled.

7.   (Original) The disk array apparatus according to claim 6, further comprising a position information storage section which stores position information in said hard disk drives of the data written in said hard disk drives in a power saving mode in said memory for said write request,

wherein said power saving mode cancellation section generates data to be stored at positions indicated by said position information of said hard disk drives in a power saving mode using the redundancy of said RAID group from the data stored in said hard disk drives not in a power saving mode out of said hard disk drives making up said logical volume and stores said generated data in said hard disk drives whose power saving mode has been canceled.

8.   (Previously Presented) A disk array apparatus connected to an information processing apparatus so as to be able to communicate therewith, comprising:

a plurality of first hard disk drives which perform data transmission/reception according to a first interface standard;

a plurality of second hard disk drives which perform data transmission/reception according to a second interface standard having a shorter life than said first hard disk drives;

a controller constructed by including a host interface which receives a request for a data read and request for a data write from/to said first or second hard disk drives from said information processing apparatus, a disk interface connected to said first or second hard disk drives so as to be able to communicate therewith through a communication path which performs data input/output to/from said first or second hard disk drives, a memory, a CPU which controls said host interface and said disk interface and a time counting mechanism,

wherein a logical volume is formed in a RAID group made up of a plurality of said first or second hard disk drives, said disk array apparatus comprising:

an access time storage section which stores, upon reception of a request for a data read or request for a data write from/to said logical volume from said information processing apparatus, a first time acquired from said time counting mechanism as an access time in said memory in association with an identifier of said RAID group in which said logical volume is formed;

a power saving mode execution section which refers to said access time stored in said memory, sets, for a RAID group whose difference between a second time acquired from said time counting mechanism and said access time exceeds a certain time, a number of said first hard disk drives according to disk drive redundancy of said RAID group to a power saving mode when said RAID group consists of only said first hard disk drives and sets an arbitrary number of said second hard disk drives to a power saving mode when said RAID group consists of only said second hard disk drives;

a power saving start time storage section which stores the second time acquired from said time counting mechanism as a power saving start time in said memory in association with an identifier of said RAID group when said first or

second hard disk drives are set to a power saving mode by said power saving mode execution section; and

a power saving mode cancellation section which refers to said power saving start time and cancels the power saving mode of said first or second hard disk drives in a power saving mode when the difference between said power saving start time and a third time acquired from said time counting mechanism exceeds a certain time.

9.   (Original) The disk array apparatus according to claim 8,

wherein the usage mode of each said RAID group is stored in said memory, and

when said RAID group consists of said first hard disk drives and said second hard disk drives, said power saving mode execution section sets a number according to the redundancy of said RAID group or an arbitrary number of said first or second hard disk drives to a power saving mode according to said usage mode of said RAID group.

10.   (Previously Presented) The disk array apparatus according to claim 8, further comprising:

a continuous operation time storage section which stores a continuous operation time for each said RAID group in said memory; and

a batch spare execution section which stores duplicates of data stored in all said first or second hard disk drives making up said RAID group whose said continuous operation time exceeds a certain time in spare drives which are reserved parts of said first or second hard disk drives and sets all said first or second hard disk drives making up said RAID group to a power saving mode.

11.   (Original) The disk array apparatus according to claim 8, further comprising an accumulated operation time storage section which stores an accumulated operation time for each of said first or second hard disk drives in said memory,

wherein said power saving mode execution section sets said first or second hard disk drives whose said accumulated operation time is long out of said first or second hard disk drives making up said RAID group to a power saving mode.

12. (Original) The disk array apparatus according to claim 11, wherein after canceling the power saving mode of said first or second hard disk drives whose power saving mode cancellation section is set to a power saving mode, said power saving mode execution section sets said first or second hard disk drives whose said operation time is long out of said first or second hard disk drives of the RAID group including said first or second hard disk drives to a power saving mode.

13. (Previously Presented) The disk array apparatus according to claim 8, further comprising:

a load time storage section which stores the time at which the head of each of said first or second hard disk drives is loaded as the load time in said memory; and

an unload execution section which unloads the heads of said hard disk drives whose difference between said load time and the time acquired from said time counting mechanism exceeds a certain time.

14. (Original) The disk array apparatus according to claim 8, further comprising:

an accumulated operation time storage section which stores the accumulated operation time of each of said first or second hard disk drives in said memory;

an error count storage section which stores a count of errors produced at each of said first or second hard disk drives in said memory; and

a dynamic spare execution section which stores duplicates of data stored in said first or second hard disk drives whose said error count exceeds a predetermined error count according to said accumulated operation time in spare drives which are reserved parts of said first or second hard disk drives.

15. (Original) The disk array apparatus according to claim 8, further comprising a read request responding section which responds, upon reception of said request for a read from said logical volume formed by including said first hard disk drives in said power saving mode from said information processing apparatus, to said read request using the redundancy of said RAID group from said first hard disk drives not in a power saving mode out of said first hard disk drives making up said logical volume, cancels, upon reception of said request for a read from said logical volume formed by including said second hard disk drives in said power saving mode from said

information processing apparatus, the power saving mode of said second hard disk drives in a power saving mode and responds to said read request.

16.   (Original) The disk array apparatus according to claim 8, further comprising:

a spare drive storage section which stores duplicates of data stored in said first hard disk drives in spare drives which are reserved parts of said first or second hard disk drives before said power saving mode execution section sets said first hard disk drives to a power saving mode; and

a write request responding section which responds, upon reception of said request for a write to said logical volume formed by including said first hard disk drives in a power saving mode, to said write request by regarding said first hard disk drives not in a power saving mode out of said first hard disk drives making up said logical volume and said spare drives as said RAID group in which said logical volume is formed,

wherein said power saving mode cancellation section stores duplicates of data stored in said spare drives in said first hard disk drives whose power saving mode has been canceled.

17.   (Original) The disk array apparatus according to claim 16, further comprising a position information storage section which stores position information of data written in said spare drives by said write request responding section according to said write request in said memory, wherein said power saving mode cancellation section stores duplicates of said data stored at positions indicated by said position information of said spare drives in said first hard disk drives whose power saving mode has been canceled.

18.   (Original) The disk array apparatus according to claim 8, further comprising a write request responding section which writes, upon reception of said request for a write to said logical volume formed by including said first hard disk drives in a power saving mode, data accompanying said write request in said first hard disk drives not in a power saving mode out of said first hard disk drives making up said logical volume and responds to said write request,

wherein said power saving mode cancellation section generates data to be

stored in said first hard disk drives in a power saving mode using the redundancy of said RAID group from the data stored in said first hard disk drives not in a power saving mode out of said first hard disk drives making up said logical volume and stores said generated data in said first hard disk drives whose power saving mode has been canceled.

19.   (Original) The disk array apparatus according to claim 18, further comprising a position information storage section which stores, in response to said write request, the position information in said first hard disk drives of the data written in said first hard disk drives in a power saving mode,

        wherein said power saving mode cancellation section generates data to be stored at the positions indicated by said position information of said first hard disk drives in a power saving mode using the redundancy of said RAID group from the data stored in said first hard disk drives not in a power saving mode out of said first hard disk drives making up said logical volume and stores said generated data in said first hard disk drives whose power saving mode has been canceled.

20.   (Previously Presented) A method of controlling a disk array apparatus connected to an information processing apparatus so as to be able to communicate therewith, comprising:

        a plurality of first hard disk drives which perform data transmission/reception according to a first interface standard;

        a plurality of second hard disk drives which perform data transmission/reception according to a second interface standard having a shorter life than said first hard disk drives;

        a controller constructed by including a host interface which receives a request for a data read and request for a data write from/to said first or second hard disk drives from said information processing apparatus, a disk interface connected to said first or second hard disk drives so as to be able to communicate therewith through a communication path which performs data input/output to/from said first or second hard disk drives, a memory, a CPU which controls said host interface and said disk interface and a time counting mechanism,

        wherein a logical volume is formed in a RAID group made up of a plurality of

said first or second hard disk drives, said disk array apparatus controlling method comprising:

a step of storing, upon reception of a request for a data read or request for a data write from/to said logical volume from said information processing apparatus, a first time acquired from said time counting mechanism as an access time in said memory in association with an identifier of said RAID group in which said logical volume is formed;

a step of referring to said access time stored in said memory and checking whether the difference between a second time acquired from said time counting mechanism and said access time exceeds a certain time or not;

a step of setting a number of said first hard disk drives according to disk drive redundancy of said RAID group to a power saving mode when said RAID group whose difference between the second time acquired from said time counting mechanism and said access time exceeds a certain time consists of only said first hard disk drives;

a step of setting an arbitrary number of said second hard disk drives to a power saving mode when said RAID group whose difference between the second time acquired from said time counting mechanism and said access time exceeds a certain time consists of only said second hard disk drives;

a step of storing, when said first or second hard disk drives are set to a power saving mode, a third time acquired from said time counting mechanism as a power saving start time in said memory in association with an identifier of said RAID group; and

a step of referring to said power saving start time and canceling the power saving mode of said first or second hard disk drives in a power saving mode when the difference between said power saving start time and the third time acquired from said time counting mechanism exceeds a certain time.

21.   (Previously Presented) A disk array apparatus connected to an information processing apparatus so as to be able to communicate therewith, comprising:

a plurality of hard disk drives; and

a controller constructed by including a host interface which receives a request for a data read and request for a data write from/to said hard disk drives from said

information processing apparatus, a disk interface connected to said hard disk drives so as to be able to communicate therewith through a communication path which performs data input/output to/from said hard disk drives, a memory, a CPU which controls said host interface, said disk interface, and a time counting mechanism,

wherein a logical volume is formed in a RAID group with redundancy made up of a plurality of said hard disk drives, said disk array apparatus comprising:

an access time storage section which stores, upon reception of a request for a data read or request for a data write from/to said logical volume from said information processing apparatus, a time acquired from said time counting mechanism as an access time in said memory in association with an identifier of said RAID group in which said logical volume is formed; and

a power saving mode execution section which refers to said access time stored in said memory and sets a number of said hard disk drives of said RAID group as less than a total number of said hard disk drives constituting said RAID group to a power saving mode when the difference between a current time acquired from said time counting mechanism and said access time exceeds a certain time.

22. (Previously Presented) A disk array apparatus connected to an information processing apparatus so as to be able to communicate therewith, comprising:

a plurality of first hard disk drives which perform data transmission/reception according to a first interface standard;

a plurality of second hard disk drives which perform data transmission/reception according to a second interface standard having a shorter life than said first hard disk drives;

a controller constructed by including a host interface which receives a request for a data read and request for a data write from/to said first or second hard disk drives from said information processing apparatus, a disk interface connected to said first or second hard disk drives so as to be able to communicate therewith through a communication path which performs data input/output to/from said first or second hard disk drives, a memory, a CPU which controls said host interface and said disk interface and a time counting mechanism,

wherein a logical volume is formed in a RAID group made up of a plurality of said first or second hard disk drives, said disk array apparatus comprising:

an access time storage section which stores, upon reception of a request for a data read or request for a data write from/to said logical volume from said information processing apparatus, a first time acquired from said time counting mechanism as an access time in said memory in association with an identifier of said RAID group in which said logical volume is formed;

a power saving mode execution section which refers to said access time stored in said memory, sets, for a RAID group whose difference between a second time acquired from said time counting mechanism and said access time exceeds a certain time, a number of said first hard disk drives of said RAID group as less than a total number of said first hard disk drives constituting said RAID group to a power saving mode when said RAID group consists of only said first hard disk drives and sets an arbitrary number of said second hard disk drives to a power saving mode when said RAID group consists of only said second hard disk drives;

a power saving start time storage section which stores the second time acquired from said time counting mechanism as a power saving start time in said memory in association with an identifier of said RAID group when said first or second hard disk drives are set to a power saving mode by said power saving mode execution section; and

a power saving mode cancellation section which refers to said power saving start time and cancels the power saving mode of said first or second hard disk drives in a power saving mode when the difference between said power saving start time and a third time acquired from said time counting mechanism exceeds a certain time.

23.   (Previously Presented) A method of controlling a disk array apparatus connected to an information processing apparatus so as to be able to communicate therewith, comprising:

a plurality of first hard disk drives which perform data transmission/reception according to a first interface standard;

a plurality of second hard disk drives which perform data transmission/reception according to a second interface standard having a shorter life than said first hard disk drives;

a controller constructed by including a host interface which receives a request for a data read and request for a data write from/to said first or second hard disk

drives from said information processing apparatus, a disk interface connected to said first or second hard disk drives so as to be able to communicate therewith through a communication path which performs data input/output to/from said first or second hard disk drives, a memory, a CPU which controls said host interface and said disk interface and a time counting mechanism,

wherein a logical volume is formed in a RAID group made up of a plurality of said first or second hard disk drives, said disk array apparatus controlling method comprising:

a step of storing, upon reception of a request for a data read or request for a data write from/to said logical volume from said information processing apparatus, a first time acquired from said time counting mechanism as an access time in said memory in association with an identifier of said RAID group in which said logical volume is formed;

a step of referring to said access time stored in said memory and checking whether the difference between a second time acquired from said time counting mechanism and said access time exceeds a certain time or not;

a step of setting a number of said first hard disk drives of said RAID group as less than a total number of said first hard disk drives constituting said RAID group to a power saving mode when said RAID group whose difference between the second time acquired from said time counting mechanism and said access time exceeds a certain time consists of only said first hard disk drives;

a step of setting an arbitrary number of said second hard disk drives to a power saving mode when said RAID group whose difference between the second time acquired from said time counting mechanism and said access time exceeds a certain time consists of only said second hard disk drives;

a step of storing, when said first or second hard disk drives are set to a power saving mode, a third time acquired from said time counting mechanism as a power saving start time in said memory in association with an identifier of said RAID group; and

a step of referring to said power saving start time and canceling the power saving mode of said first or second hard disk drives in a power saving mode when the difference between said power saving start time and the third time acquired from said time counting mechanism exceeds a certain time.